

CLAIMS:

1. A molecular weight-enlarged, homogeneously soluble ligand, comprising:
- 5 a weight average molecular weight of at least 1000 g/mol;
- a molecular weight-enlarging polymer;
- optionally, a polymer linker; and
- at least one homochiral active center;

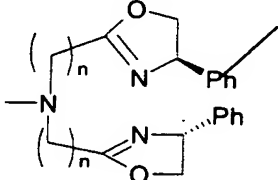
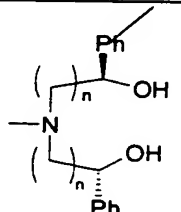
wherein said active center is bound to said molecular weight-enlarging polymer

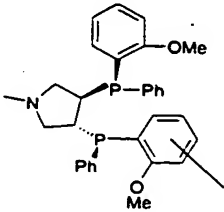
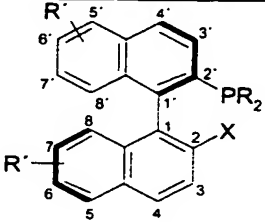
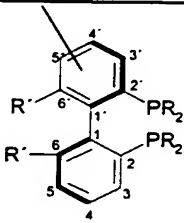
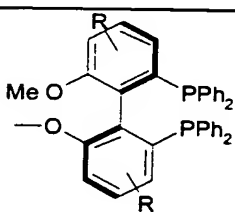
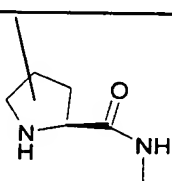
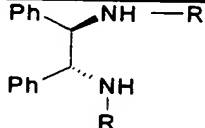
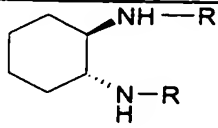
10 through said polymer linker or is bound directly to said molecular weight-enlarging polymer;

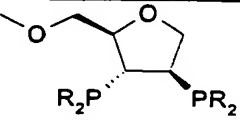
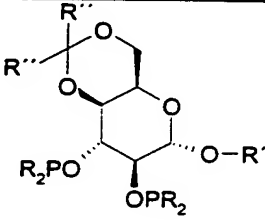
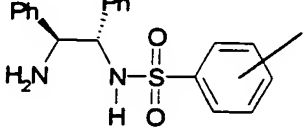
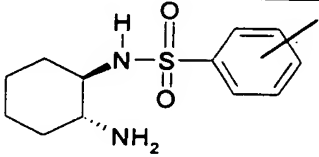
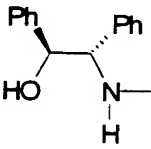
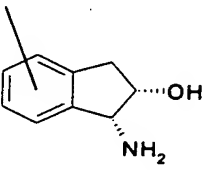
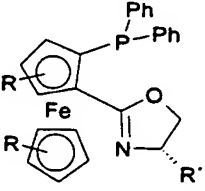
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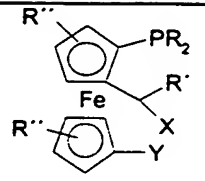
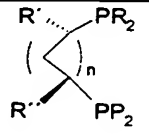
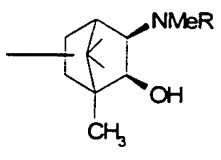
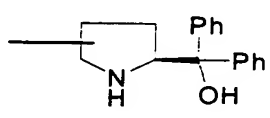
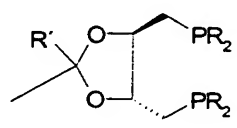
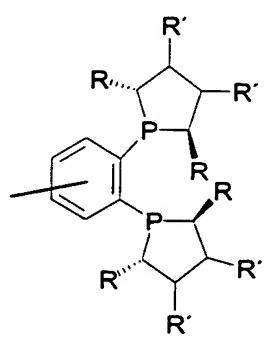
wherein said active center is selected from the group consisting of compounds having the formulas in the following table, and combinations thereof:

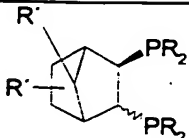
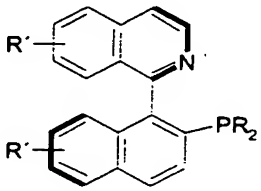
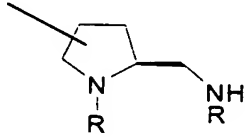
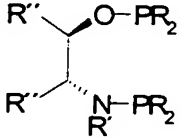
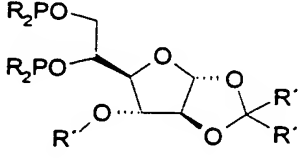
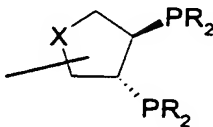
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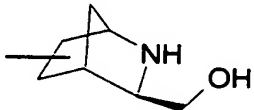
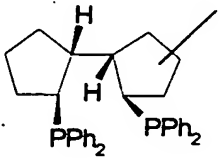
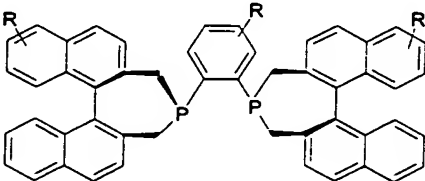
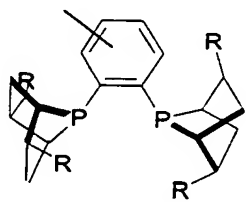
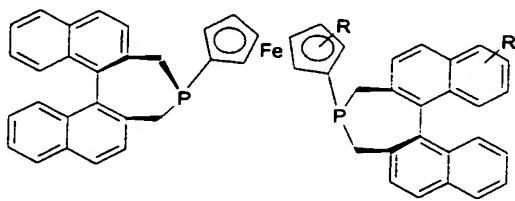
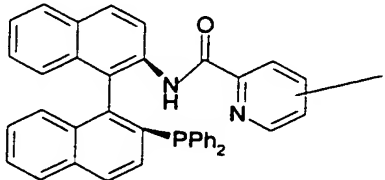
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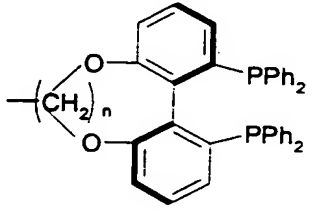
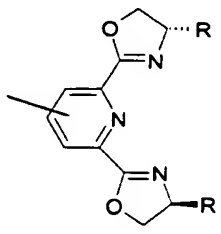
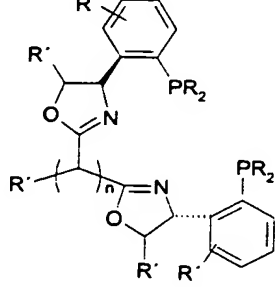
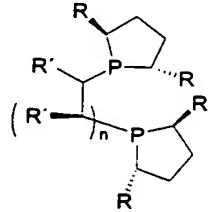
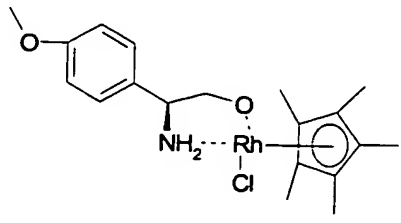
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer X = PR₂, or OMe</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = CH₃, OMe, CF₃, H, or tert.Bu</p>
	<p>R = H, CF₃, OMe, or CH₃</p>
	
	<p>R = H, (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

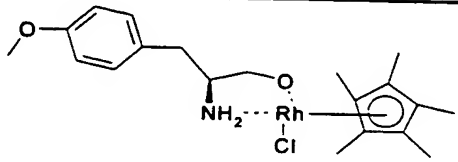
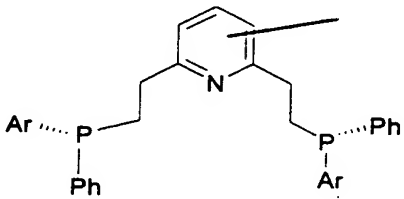
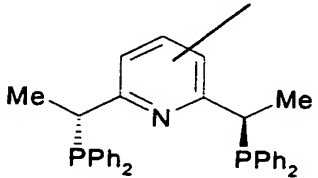
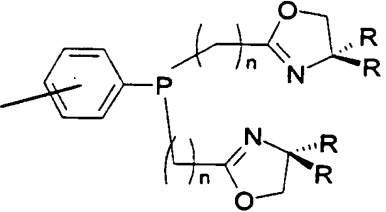
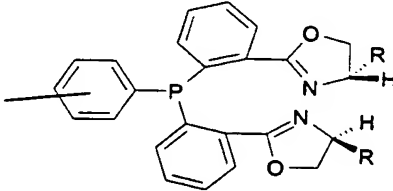
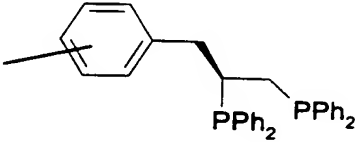
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	
	
	
	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>

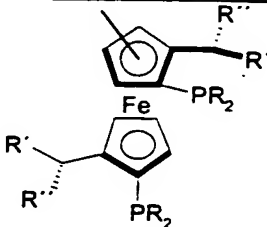
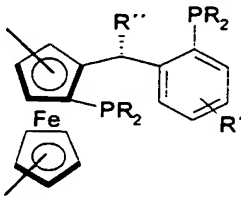
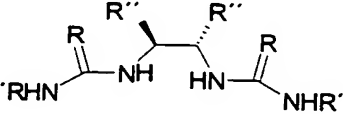
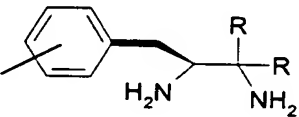
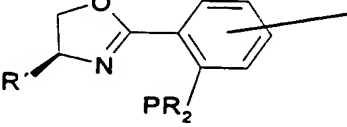
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer X = NR'₂, NR'H, OMe, OAc Y = PR₂, or H</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or H R'' = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer n = 0, 1, or 2</p>
	<p>R = H, (C₁-C₈) alkyl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or (C₆-C₁₈) aryl</p>
	<p>R = (C₁-C₈) alkyl R' = H, O-(C₁-C₈) alkyl, O-(C₇-C₁₉) aralkyl, O-(C₆-C₁₈) aryl, or OH</p>

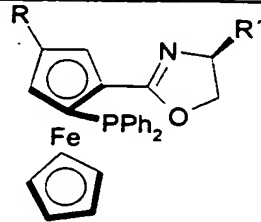
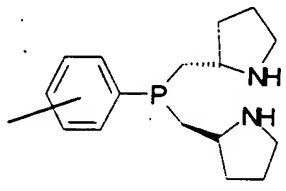
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl X = CH₂, O, S, PR, or NH</p>

	
	
	<p>R = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
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	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	

	$(n = 1-6)$
	$R = (C_1-C_8) \text{ alkyl,}$ $(C_7-C_{19}) \text{ aralkyl,}$ $(C_6-C_{18}) \text{ aryl, or}$ polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer
	$R = \text{cyclohexyl, or}$ $(C_6-C_{18}) \text{ aryl}$ $R' = H, (C_1-C_8) \text{ alkyl,}$ $(C_7-C_{19}) \text{ aralkyl,}$ $(C_6-C_{18}) \text{ aryl, or}$ polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer $n = 0-5$
	$n = 0, 1$ $R = (C_1-C_8) \text{ alkyl, or H}$ $R' = H, (C_1-C_8) \text{ alkyl,}$ $(C_7-C_{19}) \text{ aralkyl,}$ $(C_6-C_{18}) \text{ aryl, or}$ polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer
	

	
	
	
	<p>R = (C₁-C₈) alkyl, or (C₆-C₁₈) aryl, n = 0-5</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	

	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, OR', OAc, NR₂', NH₂, polymer linkage</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₆-C₁₈) aryl, OR', OAc, NR₂', NH₂, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = O, S, or NH R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl,</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, or H R' = (C₁-C₈) alkyl,</p>

	<p>(C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
<p>Bis(3,4-diarylphosphinyl)pyrrolidine</p>	

wherein a line extending from said formulas of said active center represents a bond of a binding site both for the molecular weight enlarging polymer or for the optional polymer linker;

5 wherein said polymer linker is a member selected from the group consisting of formulae a)-g):

- a) $-\text{Si}(\text{R}_2)-$
- b) $-(\text{SiR}_2-\text{O})_n-$ $n = 1-10000;$
- c) $-(\text{CHR}-\text{CHR}-\text{O})_n-$ $n = 1-10000;$
- d) $-(\text{X})_n-$ $n = 1-20;$
- e) $\text{Z}-(\text{X})_n-$ $n = 0-20;$
- f) $-(\text{X})_n-\text{W}$ $n = 0-20;$ and
- g) $\text{Z}-(\text{X})_n-\text{W}$ $n = 0-20;$

wherein

R is H, (C₁-C₈) alkyl, (C₆-C₁₈) aryl, (C₇-C₁₉) aralkyl, or ((C₁-C₈) alkyl)₁₋₃-(C₆-C₁₈) aryl;

X is (C₆-C₁₈) arylene, (C₁-C₈) alkylene, (C₁-C₈) alkenylene, ((C₁-C₈) alkyl)₁₋₃-(C₆-C₁₈) arylene, or (C₇-C₁₉) aralkylene;

5 Z is C(=O)O-, C(=O)NH-, C(=O)-, NR, O, CHR, CH₂, C=S, S, PR, Z being bound directly to said molecular weight enlarging polymer; and

W is C(=O)O-, C(=O)NH-, C(=O)-, NR, O, CHR, CH₂, C=S, S, PR, W being bound directly to said active center,

10 wherein said molecular weight enlarging polymer is a polyacrylamide or a mixture of polyacrylamide with at least one polymer selected from the group consisting of polyacrylates, polyvinylpyrrolidinones, polysiloxanes, polybutadienes, polyisoprenes, polyalkanes, polystyrenes, polyoxazolines, and polyethers.

15 2. The ligand according to claim 1, wherein said molecular weight enlarging polymer is a polyacrylamide.

3. The ligand according to claim 1, wherein said weight average molecular weight is in the range of 1,000-1,000,000 g/mol.

20 4. The ligand according to claim 1, wherein said weight average molecular weight is in the range of 5,000-300,000 g/mol.

5. The ligand according to claim 1, wherein said ligand is homogeneously soluble.

6. The ligand according to claim 1, wherein said homochiral active center is a ligand on a metal or metal ion selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt, Co, and ions thereof.

5 7. The ligand according to claim 1, wherein said homochiral active center is a catalytically active center.

8. The ligand according to claim 1, wherein said active center is bound to said polymer linker or said molecular weight-enlarging polymer with one or more of the open
10 bonds or polymer linkages in the compounds in said table.

9. A catalyst, comprising at least one ligand according to claim 1 and one or more metals or metal ions selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt, Co, ions thereof, and mixtures thereof.

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10. A process for the production of a ligand, comprising a step selected from the group consisting of (a) – (c):

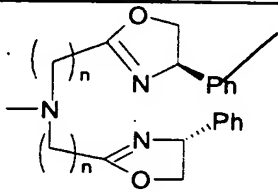
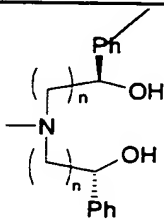
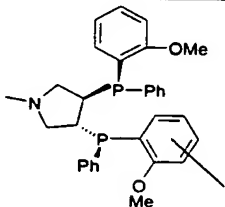
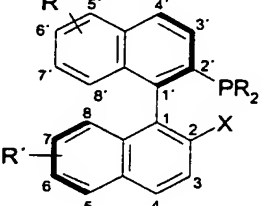
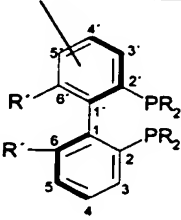
(a) binding a homochiral active center to a monomer directly or through a polymer linker to provide a modified monomer, and polymerizing said modified monomer in
20 the presence of one or more unmodified monomers;

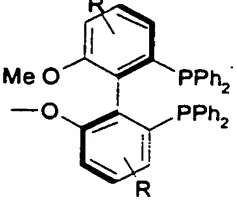
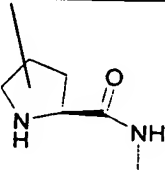
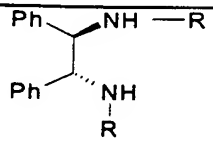
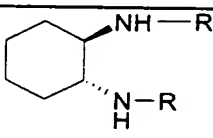
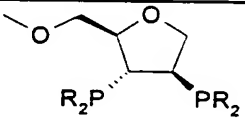
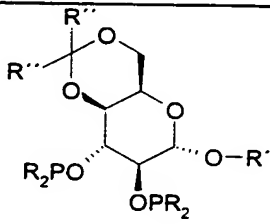
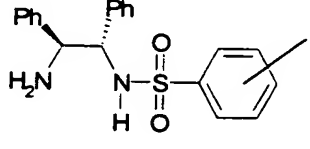
(b) binding a homochiral active center to a polymer, either directly or through a polymer linker; and

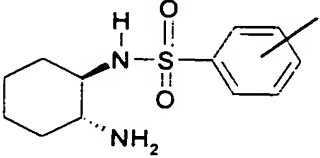
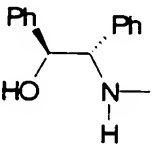
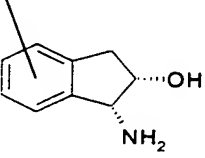
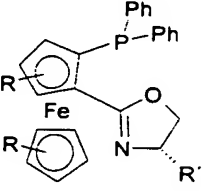
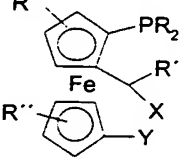
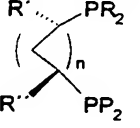
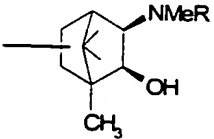
(c) carrying out either of steps (a) or (b) and further polymerizing the resulting polymer with one or more additional polymers, wherein said one or more additional polymers
25 optionally comprise one or more homochiral active centers;

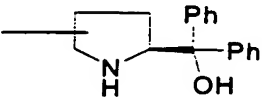
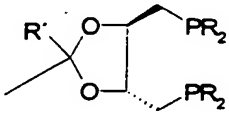
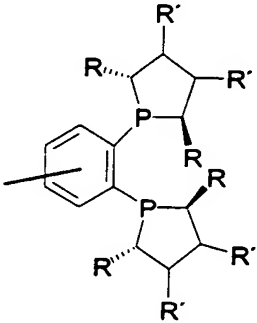
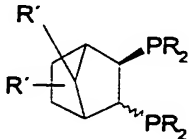
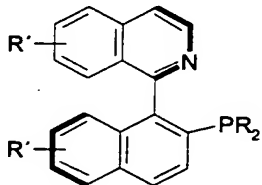
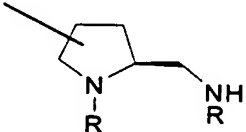
wherein said one or more homochiral active centers are selected from the group consisting of compounds having the formulas in the following table, and combinations thereof:

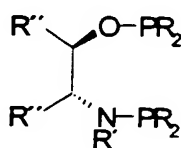
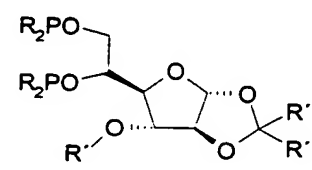
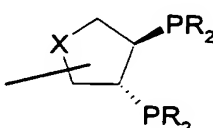
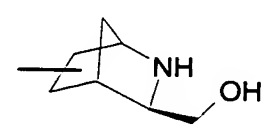
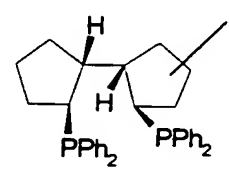
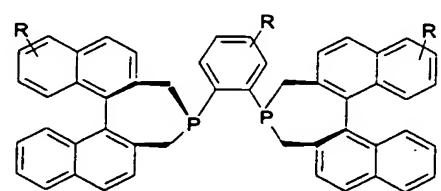
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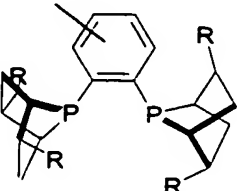
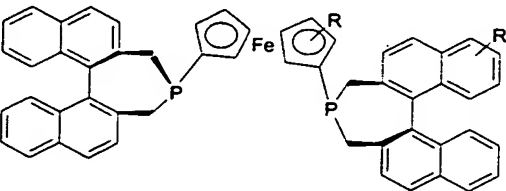
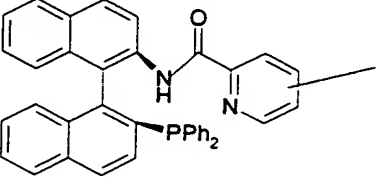
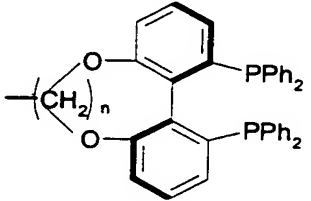
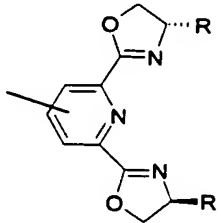
	$n = 0-5$
	$n = 0-5$
	
	$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$ $R' = \text{H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$ $X = PR_2, \text{ or OMe}$
	$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$ $R' = CH_3, OMe, CF_3, H, \text{ or tert.Bu}$

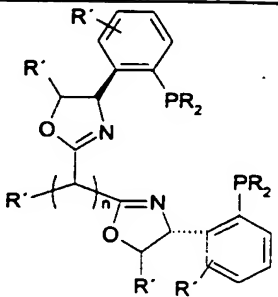
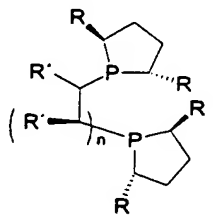
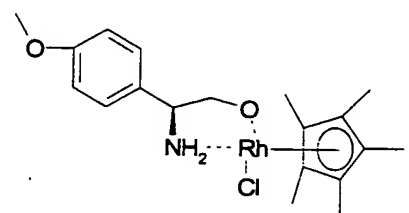
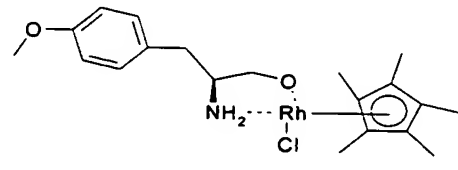
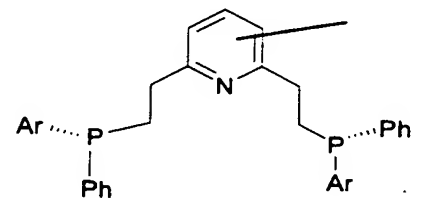
	<p>$R = H, CF_3, OMe, \text{ or } CH_3$</p>
	
	<p>$R = H, (C_1-C_8) \text{ alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$</p>
	<p>$R = H, (C_1-C_8) \text{ alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$</p>
	<p>$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$</p>
	<p>$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$ $R' = (C_1-C_8) \text{ alkyl, } (C_7-C_{19}) \text{ aralkyl, } (C_6-C_{18}) \text{ aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$ $R'' = (C_1-C_8) \text{ alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$</p>
	

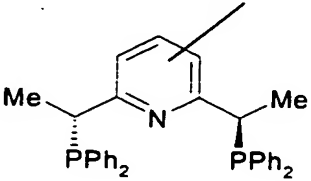
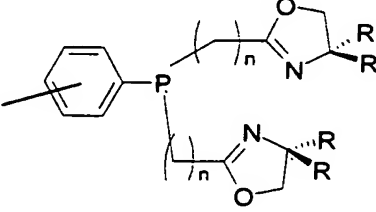
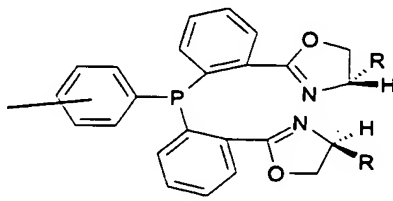
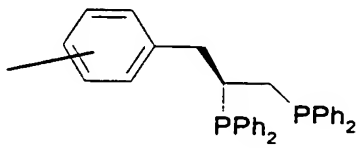
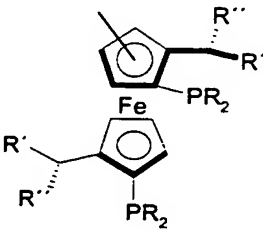
	
	
	
	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer X = NR'₂, NR'H, OMe, OAc Y = PR₂, or H</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or H R'' = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer n = 0, 1, or 2</p>
	<p>R = H, (C₁-C₈) alkyl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

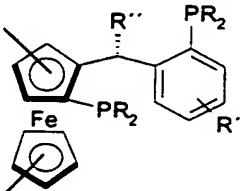
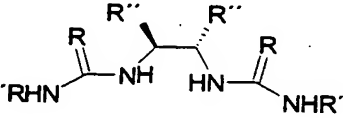
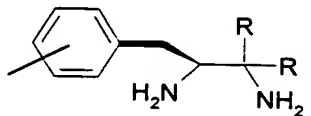
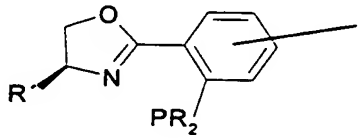
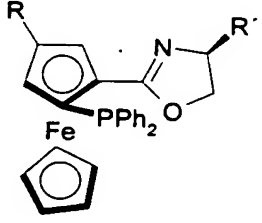
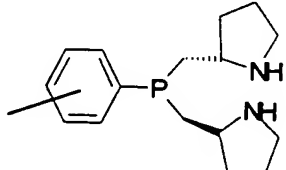
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or (C₆-C₁₈) aryl</p>
	<p>R = (C₁-C₈) alkyl R' = H, O-(C₁-C₈) alkyl, O-(C₇-C₁₉) aralkyl, O-(C₆-C₁₈) aryl, or OH</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl X = CH₂, O, S, PR, or NH</p>
	
	
	<p>R = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

	<p>R = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	<p>(n = 1-6)</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer n = 0-5</p>
	<p>n = 0, 1 R = (C₁-C₈) alkyl, or H R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	
	

	
	<p>R = (C₁-C₈) alkyl, or (C₆-C₁₈) aryl, n = 0-5</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, OR', OAc, NR₂', NH₂, polymer linkage</p>

	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₆-C₁₈) aryl, OR', OAc, NR₂', NH₂, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = O, S, or NH R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl,</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, or H R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	

Bis(3,4-diarylphosphinyl)pyrrolidine	
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wherein a line extending from said formulas of said active center represents a bond of a binding site both for the molecular weight enlarging polymer or for the optional polymer linker;

5 wherein said polymer linker is a member selected from the group consisting of formulae a)-g):

- a) $-\text{Si}(\text{R}_2)-$
- b) $-(\text{SiR}_2-\text{O})_n-$ $n = 1-10000;$
- c) $-(\text{CHR}-\text{CHR}-\text{O})_n-$ $n = 1-10000;$
- 10 d) $-(\text{X})_n-$ $n = 1-20;$
- e) $\text{Z}-(\text{X})_n-$ $n = 0-20;$
- f) $-(\text{X})_n-\text{W}$ $n = 0-20;$ and
- g) $\text{Z}-(\text{X})_n-\text{W}$ $n = 0-20;$

wherein

15 R is H, (C_1-C_8) alkyl, $(\text{C}_6-\text{C}_{18})$ aryl, $(\text{C}_7-\text{C}_{19})$ aralkyl, or $((\text{C}_1-\text{C}_8)$ alkyl) $_{1-3}$ - $(\text{C}_6-\text{C}_{18})$ aryl;

X is $(\text{C}_6-\text{C}_{18})$ arylene, (C_1-C_8) alkylene, (C_1-C_8) alkenylene, $((\text{C}_1-\text{C}_8)$ alkyl) $_{1-3}$ - $(\text{C}_6-\text{C}_{18})$ arylene, or $(\text{C}_7-\text{C}_{19})$ aralkylene;

Z is $\text{C}(=\text{O})\text{O}-$, $\text{C}(=\text{O})\text{NH}-$, $\text{C}(=\text{O})-$, NR, O, CHR, CH_2 , C=S, S, PR, Z being bound

20 directly to said molecular weight enlarging polymer; and

W is $\text{C}(=\text{O})\text{O}-$, $\text{C}(=\text{O})\text{NH}-$, $\text{C}(=\text{O})-$, NR, O, CHR, CH_2 , C=S, S, PR, W being bound directly to said active center,

wherein said molecular weight enlarging polymer is a polyacrylamide or a mixture of polyacrylamide with at least one polymer selected from the group consisting of polyacrylates, polyvinylpyrrolidinones, polysiloxanes, polybutadienes, polyisoprenes, polyalkanes, polystyrenes, polyoxazolines, and polyethers.

5

11. The process according to claim 10, wherein said molecular weight enlarging polymer is a polyacrylamide.

12. The process according to claim 10, wherein said weight average molecular
10 weight is in the range of 1,000-1,000,000 g/mol.

13. The process according to claim 10, wherein said weight average molecular weight is in the range of 5,000-300,000 g/mol.

15 14. The process according to claim 10, wherein said ligand is homogeneously soluble.

15. The process according to claim 10, wherein said homochiral active center is a ligand on a metal or metal ion selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt,
20 Co, and ions thereof.

16. The process according to claim 10, wherein said active center is bound to said polymer linker or said molecular weight-enlarging polymer with one or more of the open bonds or polymer linkages in the compounds in said table.

25

17. The method according to claim 10, further comprising contacting said ligand with one or more metals or metal ions selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt, Co, ions thereof, and mixtures thereof.

5 18. A process comprising producing one or more enantiomerically enriched organic compounds, comprising:

performing a reaction on a starting material comprising at least one non-chiral site to convert said non-chiral site into a chiral site;

10 wherein said reaction is performed in the presence of a catalyst for said reaction, said catalyst comprising at least one molecular weight-enlarged ligand, which comprises:

a weight average molecular weight of at least 1000 g/mol;

a molecular weight-enlarging polymer;

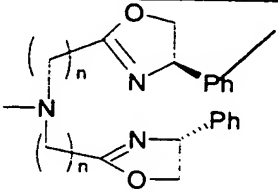
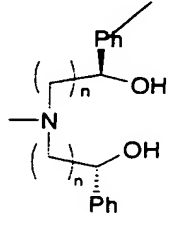
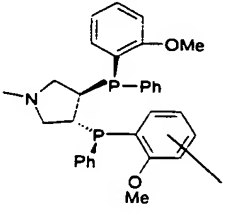
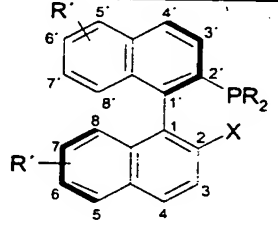
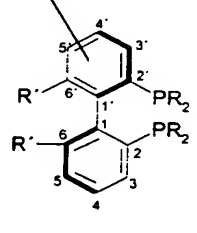
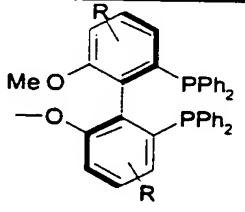
optionally, a polymer linker; and

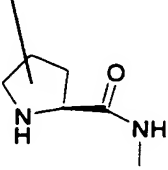
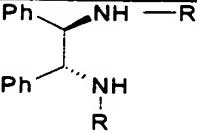
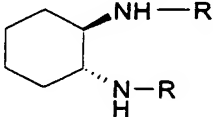
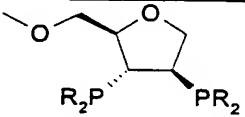
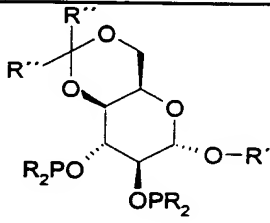
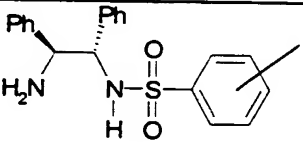
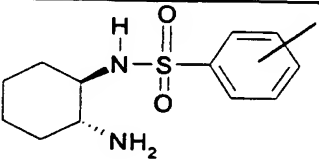
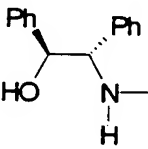
at least one homochiral active center;

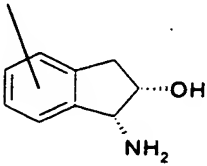
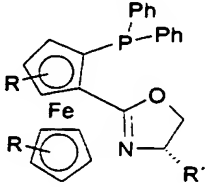
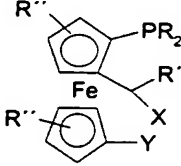
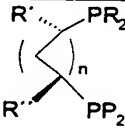
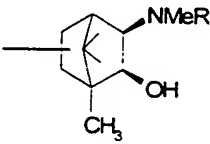
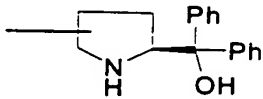
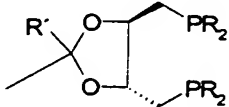
15 wherein said active center is bound to said molecular weight-enlarging polymer through said polymer linker or is bound directly to said molecular weight-enlarging polymer; and

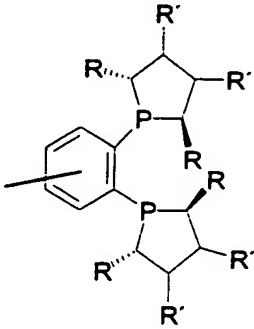
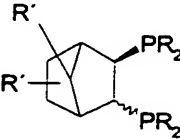
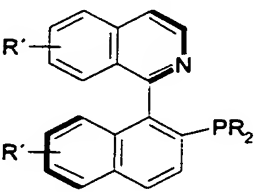
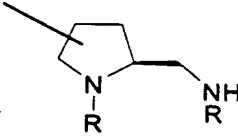
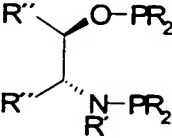
wherein said active center is selected from the group consisting of compounds having the formulas in the following table, and combinations thereof:

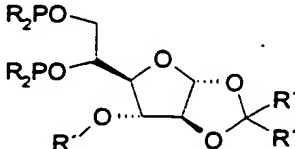
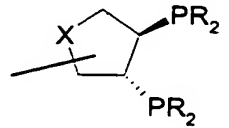
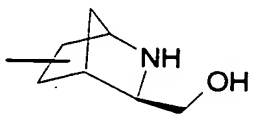
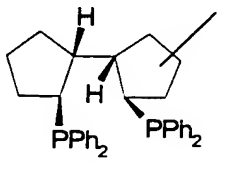
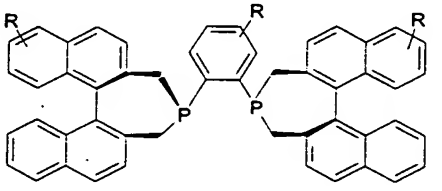
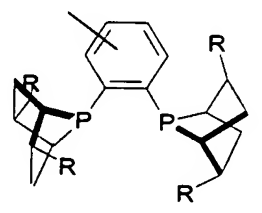
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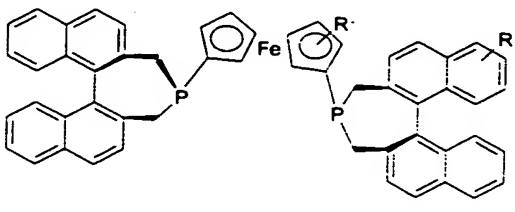
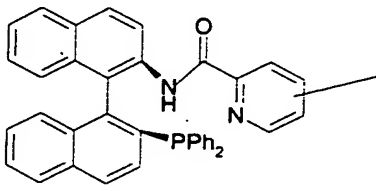
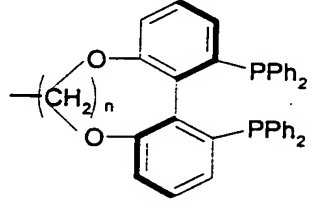
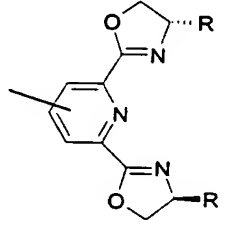
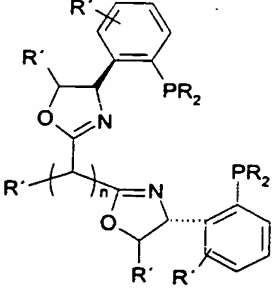
	$n = 0-5$
	$n = 0-5$
	
	$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$ $R' = \text{H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer}$ $X = PR_2, \text{ or } OMe$
	$R = \text{cyclohexyl, or } (C_6-C_{18}) \text{ aryl}$ $R' = CH_3, OMe, CF_3, H, \text{ or } tert.Bu$
	$R = H, CF_3, OMe, \text{ or } CH_3$

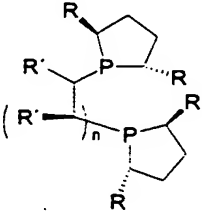
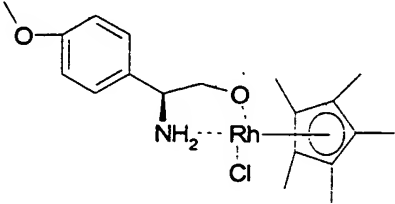
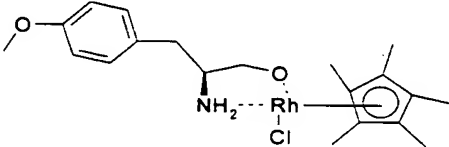
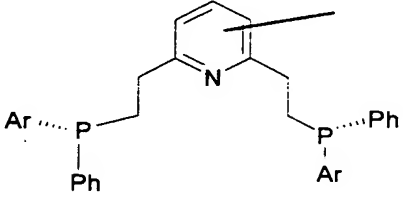
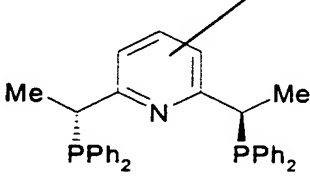
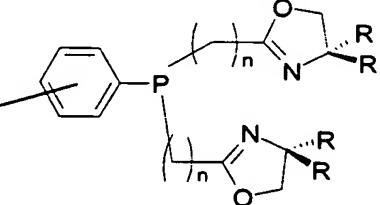
	
	<p>R = H, (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = (C₁-C₈) alkyl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	
	

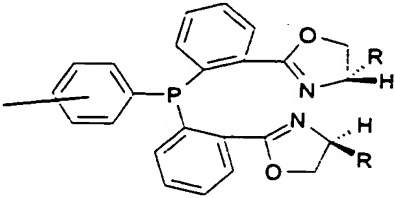
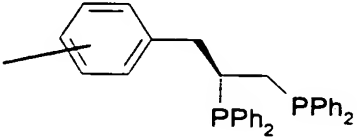
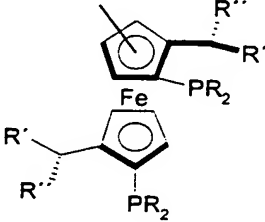
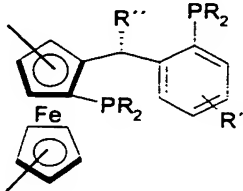
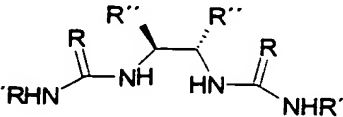
	
	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer X = NR'₂, NR'H, OMe, OAc Y = PR₂, or H</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or H R'' = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer n = 0, 1, or 2</p>
	<p>R = H, (C₁-C₈) alkyl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or (C₆-C₁₈) aryl</p>

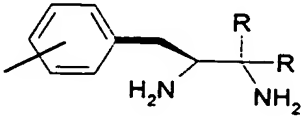
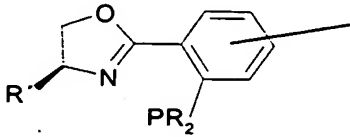
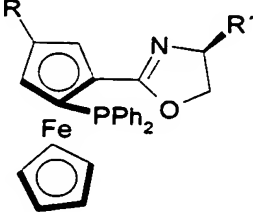
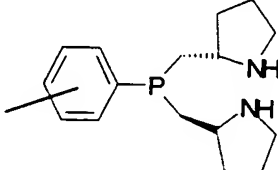
	<p>R = (C₁-C₈) alkyl R' = H, O-(C₁-C₈) alkyl, O-(C₇-C₁₉) aralkyl, O-(C₆-C₁₈) aryl, or OH</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl X = CH₂, O, S, PR, or NH</p>
	
	
	<p>R = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = H, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>

	<p>R = H, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
	<p>(n = 1-6)</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer n = 0-5</p>

	<p> $n = 0, 1$ $R = (C_1-C_8)$ alkyl, or H $R' = H, (C_1-C_8)$ alkyl, (C_7-C_{19}) aralkyl, (C_6-C_{18}) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer </p>
	
	
	
	
	<p> $R = (C_1-C_8)$ alkyl, or (C_6-C_{18}) aryl, $n = 0-5$ </p>

	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, OR', OAc, NR₂', NH₂, polymer linkage</p>
	<p>R = cyclohexyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = H, (C₁-C₈) alkyl, (C₆-C₁₈) aryl, OR', OAc, NR₂', NH₂, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	<p>R = O, S, or NH R' = H, (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl, or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer R'' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>

	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl,</p>
	<p>R = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, or (C₆-C₁₈) aryl</p>
	<p>R = polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer, or H R' = (C₁-C₈) alkyl, (C₇-C₁₉) aralkyl, (C₆-C₁₈) aryl or polymer linkage through said polymer linker or directly to said molecular weight enlarging polymer</p>
	
<p>Bis(3,4-diarylphosphinyl)pyrrolidine</p>	

wherein a line extending from said formulas of said active center represents a bond of a binding site both for the molecular weight enlarging polymer or for the optional polymer linker;

- 5 wherein said polymer linker is a member selected from the group consisting of formulae a)-g):

- a) $-\text{Si}(\text{R}_2)-$
- b) $-(\text{SiR}_2-\text{O})_n-$ $n = 1-10000;$
- c) $-(\text{CHR}-\text{CHR}-\text{O})_n-$ $n = 1-10000;$
- d) $-(\text{X})_n-$ $n = 1-20;$
- 5 e) $\text{Z}-(\text{X})_n-$ $n = 0-20;$
- f) $-(\text{X})_n-\text{W}$ $n = 0-20;$ and
- g) $\text{Z}-(\text{X})_n-\text{W}$ $n = 0-20;$

wherein

10 R is H, (C_1-C_8) alkyl, $(\text{C}_6-\text{C}_{18})$ aryl, $(\text{C}_7-\text{C}_{19})$ aralkyl, or $((\text{C}_1-\text{C}_8)$ alkyl) $_{1-3}$ - $(\text{C}_6-\text{C}_{18})$ aryl;

X is $(\text{C}_6-\text{C}_{18})$ arylene, (C_1-C_8) alkylene, (C_1-C_8) alkenylene, $((\text{C}_1-\text{C}_8)$ alkyl) $_{1-3}$ - $(\text{C}_6-\text{C}_{18})$ arylene, or $(\text{C}_7-\text{C}_{19})$ aralkylene;

Z is $\text{C}(=\text{O})\text{O}-$, $\text{C}(=\text{O})\text{NH}-$, $\text{C}(=\text{O})-$, NR, O, CHR, CH_2 , $\text{C}=\text{S}$, S, PR, Z being bound directly to said molecular weight enlarging polymer; and

15 W is $\text{C}(=\text{O})\text{O}-$, $\text{C}(=\text{O})\text{NH}-$, $\text{C}(=\text{O})-$, NR, O, CHR, CH_2 , $\text{C}=\text{S}$, S, PR, W being bound directly to said active center;

20 wherein said molecular weight enlarging polymer is a polyacrylamide or a mixture of polyacrylamide with at least one polymer selected from the group consisting of polyacrylates, polyvinylpyrrolidinones, polysiloxanes, polybutadienes, polyisoprenes, polyalkanes, polystyrenes, polyoxazolines, and polyethers.

19. The method according to claim 18, wherein said molecular weight enlarging polymer is a polyacrylamide.

20. The method according to claim 18, wherein said weight average molecular weight is in the range of 1,000-1,000,000 g/mol.

21. The method according to claim 18, wherein said weight average molecular weight is in the range of 5,000-300,000 g/mol.

22. The method according to claim 18, wherein said ligand is homogeneously soluble.

23. The method according to claim 18, wherein said homochiral active center is a ligand on a metal or metal ion selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt, Co, and ions thereof.

24. The method according to claim 18, wherein said homochiral active center is a catalytically active center.

25. The method according to claim 18, wherein said active center is bound to said polymer linker or said molecular weight-enlarging polymer with one or more of the open bonds or polymer linkages in the compounds in said table.

26. The method according to claim 18, wherein said catalyst further comprises one or more metals or metal ions selected from the group consisting of Ru, Rh, Ir, Pd, Ni, Pt, Co, ions thereof, and mixtures thereof.

27. The method according to claim 18, wherein the reaction is performed in a membrane reactor.

28. The method according to claim 18 wherein the reaction comprises hydrogenating
5 one or more C=C, C=N or C=O double bonds in said starting material.

29. The method according to claim 28, wherein said hydrogenating is performed by transfer hydrogenation.

10 30. The method according to claim 18, wherein said active center is bound to said polymer linker or said molecular weight-enlarging polymer with one or more of the open bonds or polymer linkages in the compounds in said table.